REMARKS

Claims 1, 2, 4-7 and 11-13 are pending in the present Application, of which claims 1, 2, 4-7 and 11-13 have been rejected. Claim 14 is new, leaving Claims 1, 2, 4-7 and 11-14 for consideration upon entry of the present Amendment. Support for the new claim may be found at least in FIG. 1 as originally filed. No new matter has been introduced by these amendments or new claims.

Reconsideration and allowance of the claims are respectfully requested in view of the above amendments and the following remarks.

Rejections under 35 U.S.C. §103

Choi et al. in view of Kim et al.

Claims 1, 2 and 5-7 stand rejected under 35 U.S.C § 103(a) as being allegedly unpatentable over Choi et al. (U.S. Patent No. 6,231,672 B1, hereinafter "Choi") in view of Kim et al. (U.S. Patent No. 6,656,282 B2, hereinafter "Kim"). The Examiner states that Choi discloses all of the elements of the abovementioned claims except for, (1) *a radical supply unit for generating corresponding radicals by applying plasma to a second reactive gas and then selectively supplying the radicals to the reaction chamber or the exhaust line; a radical transfer line for connecting the radical supply unit and the reaction chamber and for transporting a main purge gas; a second bypass line for connecting the radical supply unit and the exhaust line; the radical supply unit comprises an MFC 2 for controlling the flow rate of the second reactive gas; a remote plasma generator to which the MFC 2 and the MFC 3 are connected such that the second reactive gas and/or the inert gas are fed to the remote plasma generator, the remote plasma generator generating corresponding radicals by applying plasma to the second reactive gas and/or the inert gas; an open/close valve installed between the MFC 2 and the remote plasma generator* of claim 1; (2) *a radical transfer line* of claim 5; (3) *radicals are fed into the reaction chamber* and that *the deposition process is repeated* of claim 6; and (4) *after depositing a thin film, further comprising injecting radicals and an inert gas into the reaction chamber to thermally treat the thin film, wherein the radicals are formed of at least one selected from the group consisting of O, N, H, OH and NH and a combination thereof* of claim 7, which the

Examiner further states are disclosed primarily at FIG. 3 and column 3, lines 5-7, column 4, lines 60-67, column 5, lines 20-30 and column 5, lines 60-67 of Kim. The Examiner also states that Kim in view of Choi disclose all of the elements of the abovementioned claims except, *wherein the second reactive gas and the inert gas are mixed with each other prior to being fed to the remote plasma generator*, which the Examiner further states is disclosed primarily in FIG. 1 and paragraph 0035 of Ogawa.

Choi is directed to an apparatus for depositing thin films of a semiconductor device. (See Abstract). The apparatus includes a reaction gas transfer portion 1000 for transferring a reaction gas to a reactor 200 and an exhaust portion 1300 for discharging the reaction gas out of the reactor 200. (See Col. 2, line 66 through Col. 3, line 4). Choi discloses that the reaction gas transfer portion 1000 includes a first reaction gas supply portion 1110 for supplying a first reaction gas to the reactor 200, a second reaction gas supply portion 1120 for supplying a second reaction gas to the reactor 200 and an inert gas supply portion 1130 for supplying an inert gas to the reactor 200. (See Col. 3, lines 6-19). Choi also discloses that the exhaust portion 1300 has an exhaust pump 310 for discharging the gas out of the reactor 200. (*Id.)* Choi further discloses that the first, second and third gas supply portions 1110, 1120 and 1130 and the exhaust pump 310 are connected by pipe lines having a plurality of on/off valves 111, 112, 113, 114, 115, 121, 122, 123, 124, 125, 131, 132, 133 and 134, which are controlled by a connector connected to each of the valves. (*Id.*)

As noted by the Examiner on page 4 and 5 of the present Office action, Choi fails to disclose a radical supply unit as claimed.

Kim is directed to a reactive gas feeder for use in an atomic layer deposition apparatus using remote plasma. (See Col. 4, lines 19-37). The reactive gas feeder includes a plurality of transfer pipes 15 for guiding a first reactive gas, a second reactive gas and a carrier gas into a vacuum chamber 4. (*Id.*) Kim discloses that the reactive gas feeder further includes a valve controller 30 to feed a carrier gas (considered the "inert gas") to purge the reactive gas atmosphere at each process after feeding the first and second reactive gases. (See Col. 4, lines 39-43).

The Examiner asserts that one of ordinary skill in the art would be motivated to replace the second source container 126 of Choi with the remote plasma generator 7 of Kim and to

supply the remote plasma generator 7 with Kim's group of reactants and also to replace the section of Choi from valve 133 to 134 with Kim's section from valve V4 to V5. The Examiner's suggested motivation is, "to form film with remote plasma, which allows the supply of reactive materials at such low temperatures as to deposit oxide, nitride and metal thin films almost free of impurities".

However, contrary to the Examiner's suggestions, the replacement of the second source container 126 with the remote plasma generator 7 of Kim would render the apparatus of Kim inoperative. The remote plasma generator 7 would receive inert gas from the MFC along pipe section 12 and through the valve 121. There is no process gas supply line disclosed in Choi, only the source containers 116 and 126 for generating the first and second process gases. Therefore, the reactor 7 would be unable to supply a process gas to the reactor 200 and the entire apparatus would be rendered inoperable.

The Examiner tries to cure this defect by suggesting that it would also be obvious to one of ordinary skill in the art to "supply the remote plasma generator 7 with Kim's group of reactants". The Examiner's motivation for the combination is "to form film with remote plasma, which allows the supply of reactive materials at such low temperatures as to deposit oxide, nitride and metal thin films almost free of impurities as taught by Kim."

Essentially, as shown in the Examiner's schematic from the previous Final Office action, the Examiner is suggesting the replacement of the second source 126 of Choi with the remote plasma generator 7 of Kim and is also suggesting the addition of a new separate process gas source (the element labeled "Gas" in the Examiner's schematic) and a new MFC (the elements labeled "MFC2" from the Examiner's schematic) from Kim into the gas supply unit of Choi.

It is respectfully submitted that the Examiner's motivation for combining the above elements of Choi and Kim is improper. The Examiner's suggested motivation of forming a film with remote plasma would possibly be a motivation for replacing the entire second reactive supply unit 1120 of Choi with the plasma generator 7 and reactant supply of Kim; however, it is insufficient motivation for replacing only the source container 126 of the second reactive supply unit 1120. If the entire reactive supply unit 1120 of Choi were replaced with the plasma generator 7 and reactant supply of Kim, the resulting device would not produce the claimed invention.

Therefore, it is respectfully submitted that there is insufficient motivation for the particular combination of Choi and Kim, and therefore the combination of Choi and Kim is improper.

Furthermore, it is respectfully noted that Ogawa discloses an apparatus for processing substrates wherein the apparatus includes a plasma chamber 25 receiving gasses from a Hydrogen gas source 27 and a Nitrogen gas source 28. The gases from the two sources are mixed before entering the plasma chamber 25. (See FIG. 1 and paragraph 35). It is worth noting that unlike the present invention, the gases from the sources are indiscriminately mixed prior to entering the plasma chamber 25. Thus, Ogawa does not cure the defects of Choi and Kim noted above with respect to independent claim 1.

Therefore, Choi, Kim and Ogawa fail to individually teach or suggest all of the elements of independent claims 1 and 6, and for the reasons stated above, the combination of Choi and Kim is improper. Therefore, claims 1 and 6 are believed to be patentably distinct and non-obvious over the cited references. Claims 2, 5 and 7 depend from independent claims 1 and 6, and would therefore be allowable a depending from an allowable base claim.

Choi in view of Kim and Ogawa and further in view of Xia

Claims 4, 11, 12 and 13 stand rejected under 35 U.S.C § 103(a) as being allegedly unpatentable over Choi in view of Kim and Ogawa, and further in view of Xia et al. (U.S. Patent No. 6,258,735, hereinafter "Xia"). The Examiner states that Choi discloses all of the elements of the abovementioned claims except for, (1) *an atomic film deposition method using the remote-plasma atomic film deposition apparatus of claim 1, the method comprising forming a thin film on a substrate loaded in the reaction chamber by repeatedly performing a radical feeding step in which radicals are fed into the reaction chamber, a radical purge step in which the radicals are purged from the reaction chamber, wherein the radical purge step comprises injecting only a radical corresponding to the inert gas (excluding the second reactive gas), which flows through the remote plasma generator, into the reaction chamber by way of the radical transfer line* of claim 11, which the Examiner further states is disclosed primarily in FIG. 3 of Kim; (2) *wherein the sum of the flow rate of the inert gas flowing through the first reactive gas transfer line and the second reactive gas transfer line is maintained at a constant level during the first reactive*

gas purge step of claim 12, which the Examiner further states is disclosed primarily in FIG. 2 and column 5, lines 15-28 of Kim; and (3) *after depositing a thin film, further comprising injecting radicals and an inert gas into the reaction chamber to thermally treat the thin film, wherein the radicals are formed of at least one selected from the group consisting of O, N, H, OH and NH and a combination thereof* of claim 13, which the Examiner further states are disclosed primarily in FIG. 3 and column 2, lines 34-53 of Kim. The Examiner also states that Choi in view of Kim and Ogawa teach all of the elements of claims 4 and 11 except, *the radical supply unit further comprises a third bypass line for enabling the second reactive gas to selectively flow through the MFC 2 into the second bypass line*, of claim 4 and *an atomic film deposition method comprising: while a first reactive gas is purged from the reaction chamber, gases flowing through an inner point D of the radical supply unit continue to flow into the reaction chamber or bypass line*, which the Examiner further states is disclosed primarily in FIG. 1, lines 6-45.

Xia is directed to a method of depositing a carbon doped silicon oxide film having a low dielectric constant (k). (See Abstract). Xia discloses a chemical vapor deposition reactor 10 having a high vacuum region 15. (See Col. 3, lines 58-60). Xia also discloses that the deposition process performed in the reactor 10 can be either a thermal process or a plasma enhanced process. (See Col. 4, lines 31-45). Xia further discloses that, in the plasma enhanced process, a controlled plasma is formed adjacent to a wafer by RF energy. (*Id.*) However, Xia fails to cure the deficiencies of Choi, Kim and Ogawa, as discussed above.

Therefore, Choi, Kim, Ogawa and Xia, fail to teach or suggest all of the elements of independent claims 1 and 11. Claims 4, 12 and 13 would therefore be allowable as depending from independent claims 1 and 11, respectively.

New Claim 14

While it is respectfully submitted that the above arguments with respect to the combination of Choi and Kim is persuasive, claim 14 has been added as a new independent claim including a limitation which further distinguishes the present invention from the cited references.

The limitation wherein the second reactive gas and the inert gas are adjustably combined with each other prior to being fed to the remote plasma generator further distinguishes the present

invention from that shown in Ogawa wherein the two gases are non-adjustably combined, e.g., the mixing rate between the two gases is fixed in Ogawa.

Conclusion

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and withdrawal of the objection(s) and rejection(s) and allowance of the case are respectfully requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130.

Respectfully submitted,

CANTOR COLBURN LLP

By____/James J. Merrick/_____
Registration No. 43,801
Confirmation No.: 4213
Cantor Colburn LLP
20 Church Street, 22nd Floor
Hartford, CT 06103-3207
Telephone: (860) 286-2929
Fax: (860) 286-0115

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